FOCUS

Hydropower

Environmental Effects on Anadromous Fish Populations

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Resources Restoration Section

Hydropower

Environmental Effects on Anadromous Fish Populations

- Benefits & Costs of Hydro and dams
- Issue of Scale
- Fish Population Perspective
- Changing Viewpoints, Changing Rivers
- Engineering Approaches
- Fish Passage Improvement
- Dam Removal Studies in California
- Hydropower/Fish Passage Issues

Hydropower Dams as components affecting river (lotic) environments

Benefits:

- Power
- Flood control
- Recreation/navigation (lake)
- Water supply
- Economics (construction, facility operations jobs, mitigation based jobs, power revenues, etc.)

Hydropower Dams as components affecting river (lotic) environments

Trade-offs:

- Altered aquatic ecosystems
- Native species impacts (ESA)
- River-based Recreation (rafting, salmon fishing)
- Economic (mitigation-restoration costs, long-term O&M costs, impoundment management, safety repairs {<$1B/yr/20yrs}, infrastructure)

Perspectives on Hydropower Dams

National Inventory of Dams[1]:

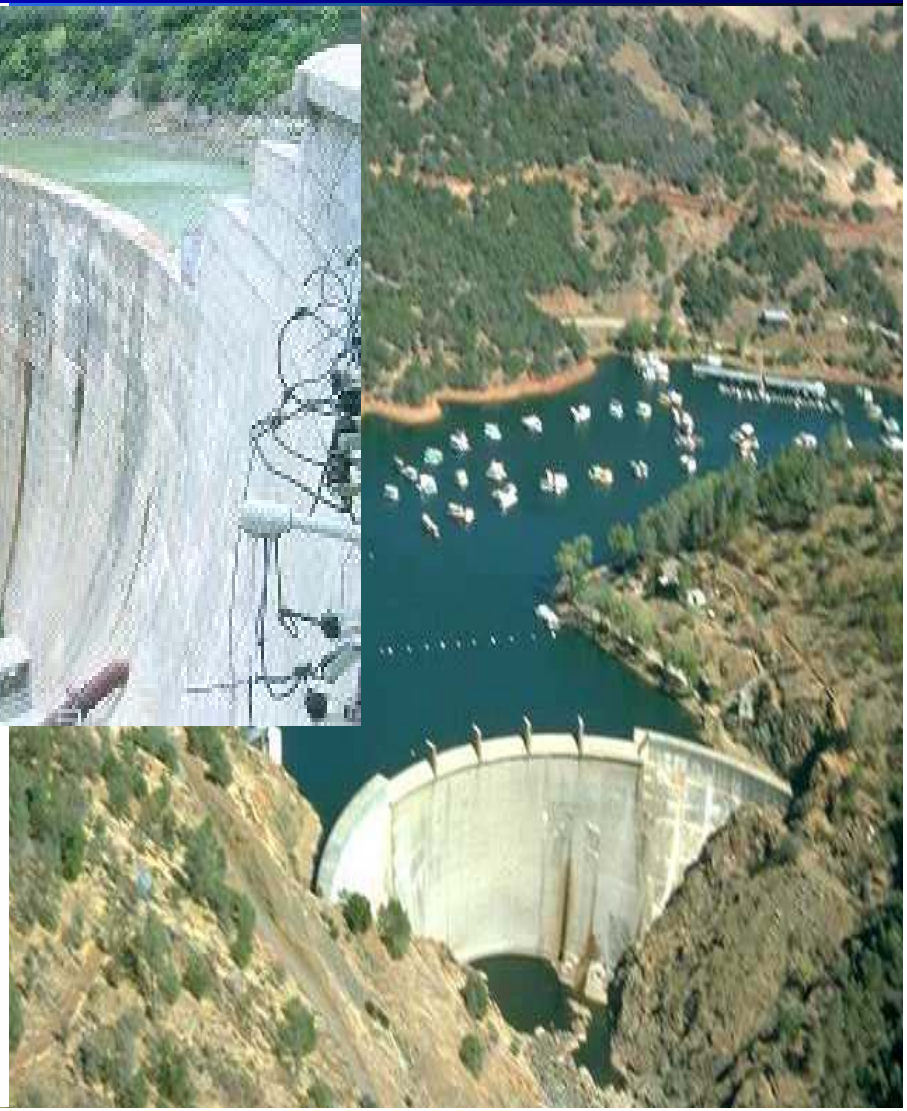
75,187 dams

2,166 hydroelectric (2.9%)

1. Army Corps of Engineers & FEMA 1996

California:

1,222 Jurisdictional dams[1]



1. DWR DSOD 1993

California:

386 Hydroelectric[1] (32%)

1. California Energy Comm. 2001

Salmonid Populations Decline

Effects of Developed Rivers and Watersheds

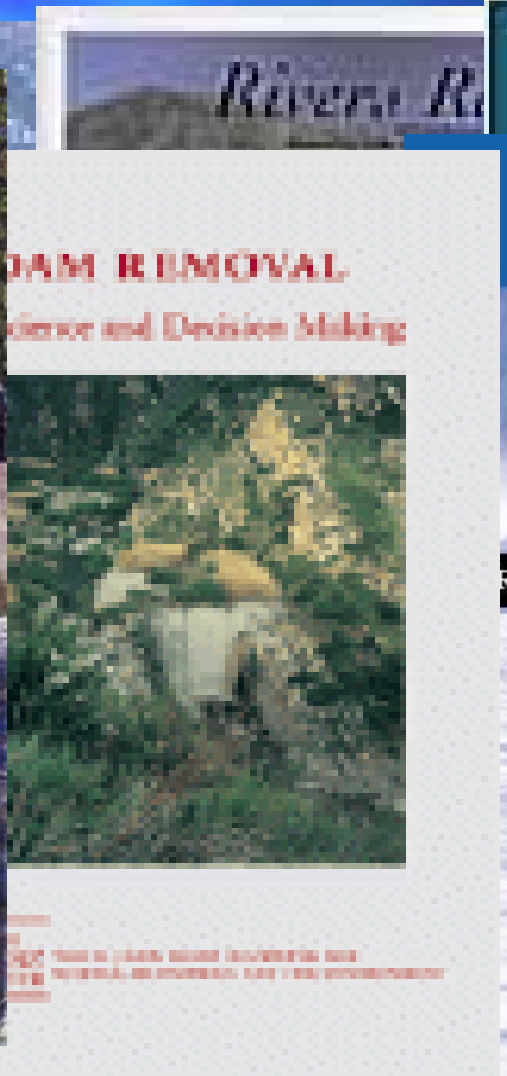
106

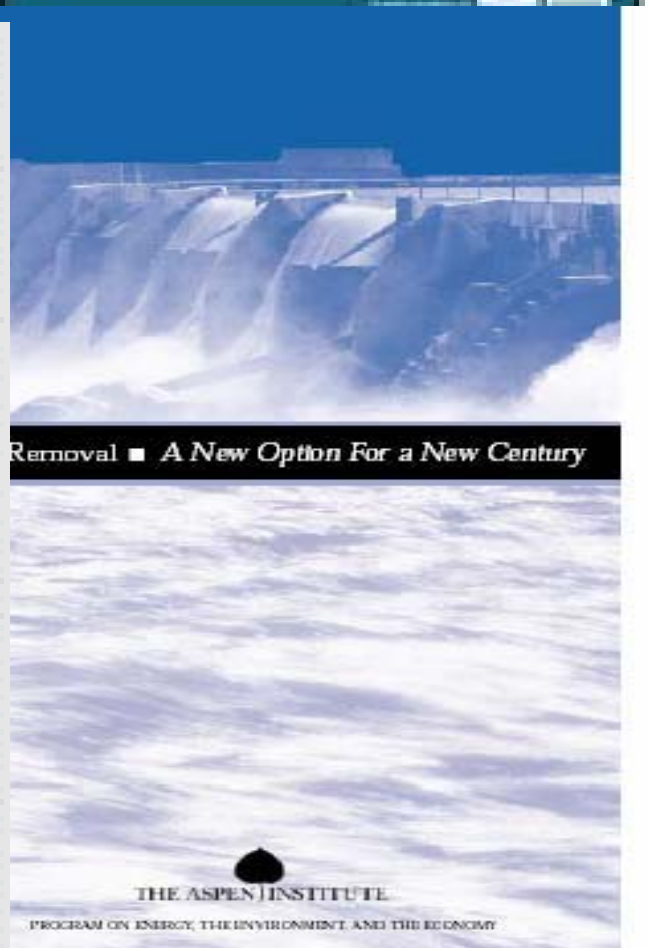
The number of salmonid populations that have gone extinct along Western North America (Levin and Schiewe 2001)

Historic Spring-run Chinook Salmon Range

Current Spring-run Chinook Salmon Range

A Dam Perspective:
In Society's Eyes





Anadromous Fisheries Issues and Hydropower

CHANGING RIVERS

Physical Processes

Biological Processes

Physical Processes

Hydropower Dams Alter:

Hydrology

- Flood peaks
- Seasonal flow (low or altered flow patterns)

Geomorphic

- Bedload transport
- Channel formation/maintenance

Biological Processes

Dams Alter:

Stream Continuity

- Habitat Fragmentation (river continuum concept (Vannote etal. 1980))
- Lotic to Lentic environment
- Temperature regimes
- Habitat conditions (spawning, rearing, riparian)

Engineered Opportunities
Fish Passage & Hydro

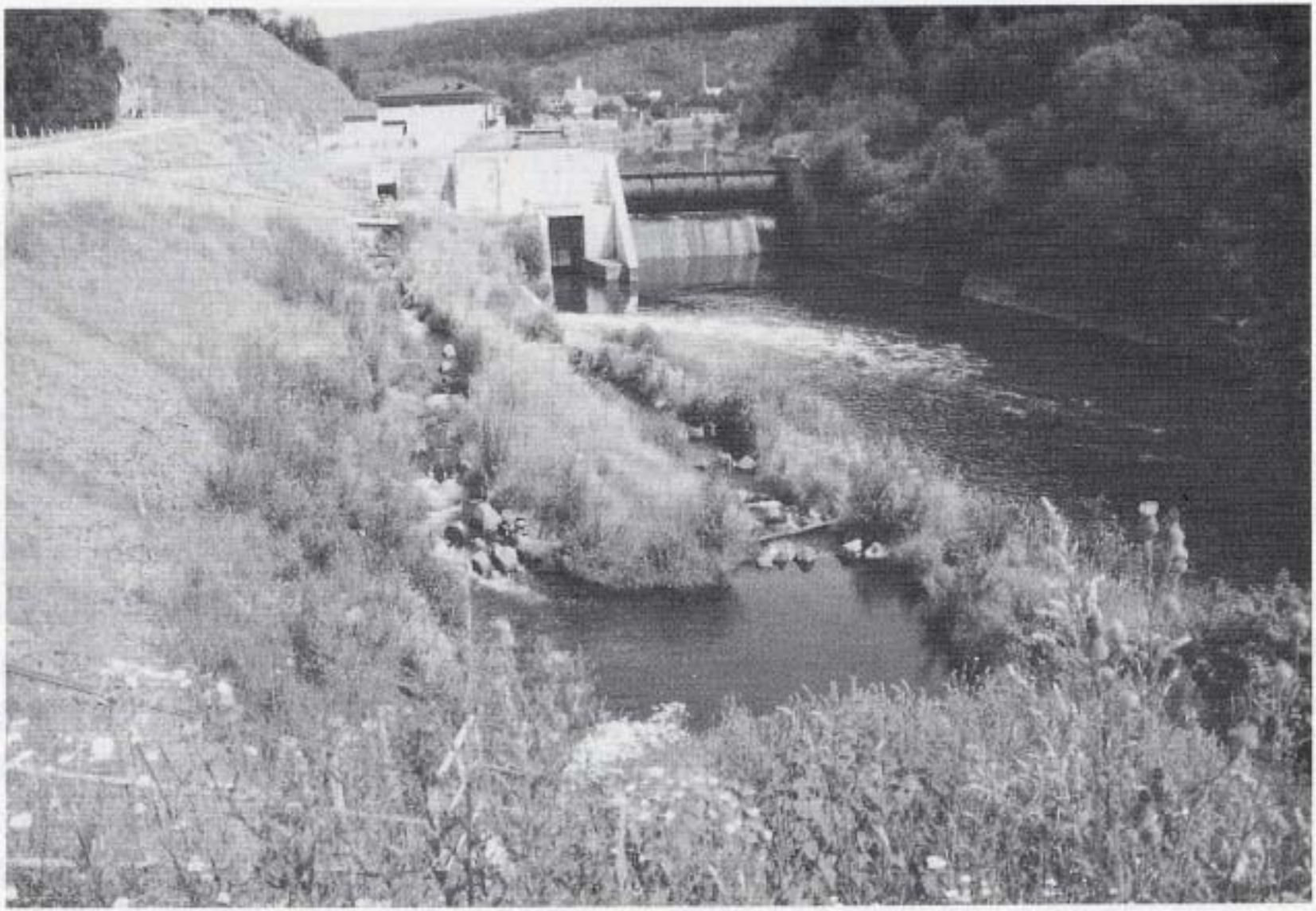
Fish Screens and guidance

Fish Ladders

Fish locks and elevators

Trap and Truck

Naturalized bypass channels



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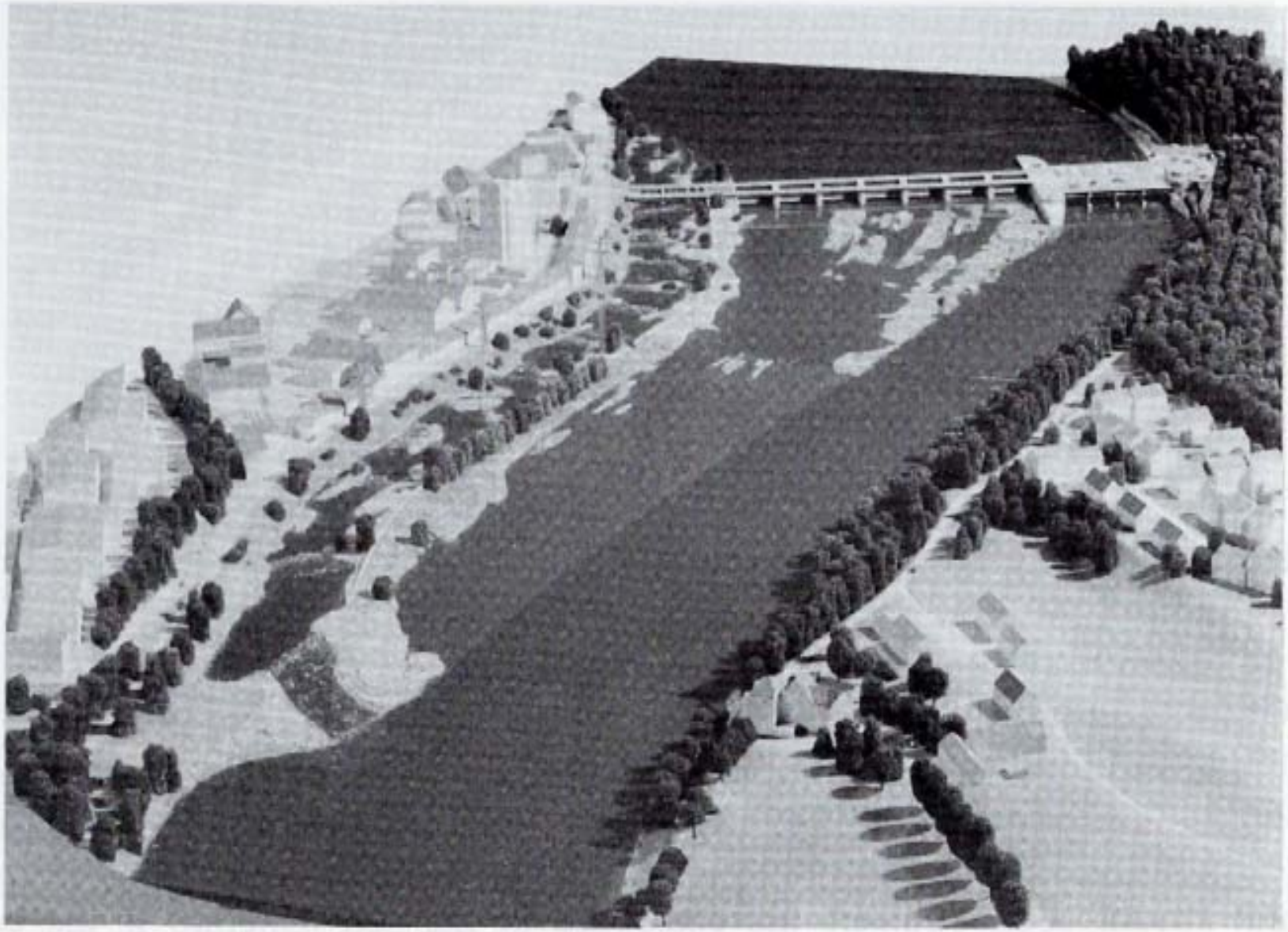


(b)

CALFED
Ecosystem
Restoration
Program

Fish Passage Improvement Program

Fish Passage Program:

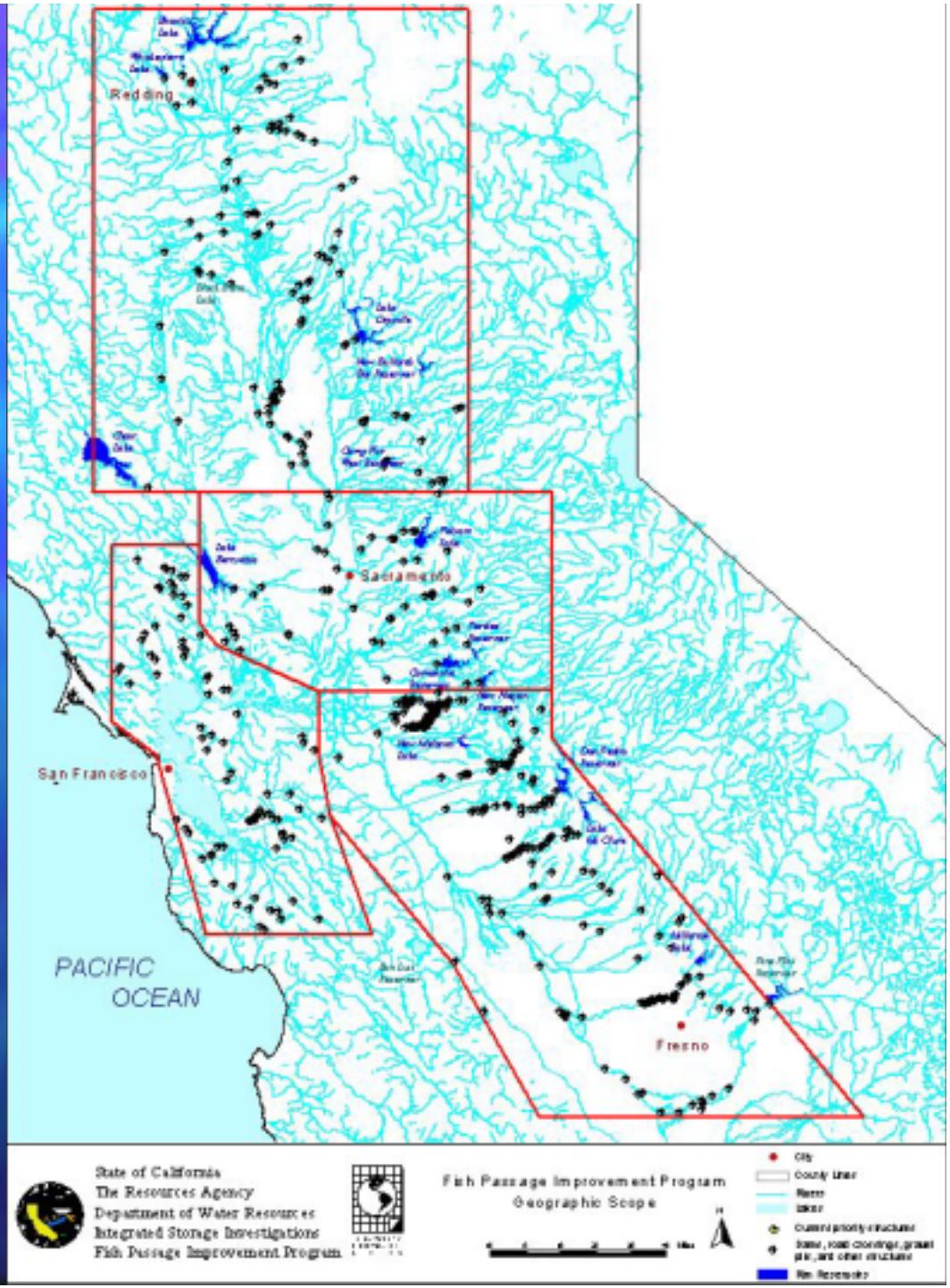
Assess the potential to improve fish migration passage by modifying or removing structural barriers and identify opportunities

DWR Bulletin 250

- **Inventory of structures**
- **Priority projects**
- **Habitat conditions**
- **Species populations distribution**

Inventory

Structures with Potential Fish Passage Migration problems



Dam Removal Studies
California

San Clemente Dam - Carmel River

Matilija Dam - Ventura River

Rindge Dam - Malibu Creek

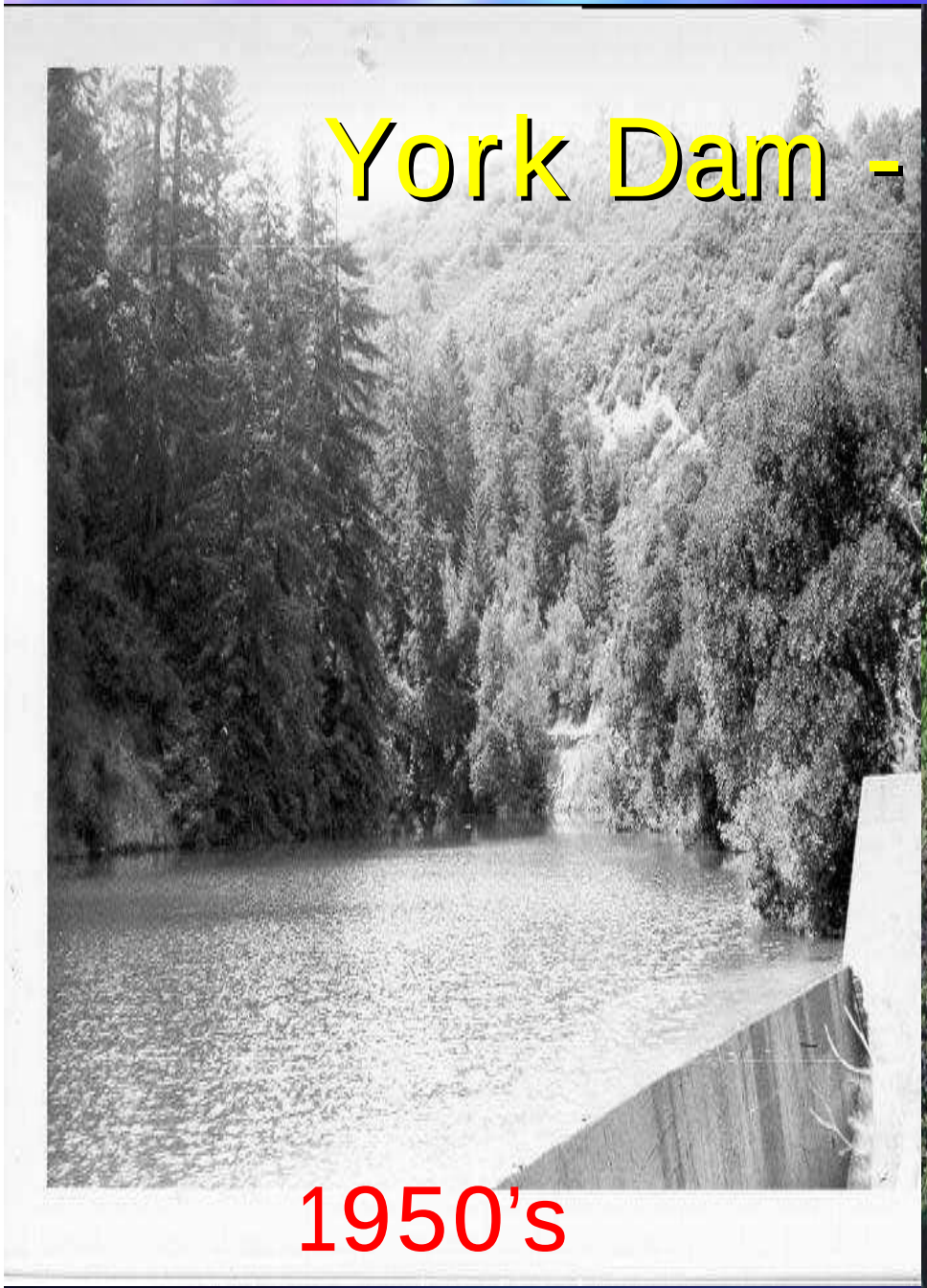
Englebright Dam - Yuba River

Eagle Canyon, Wildcat - Battle Creek

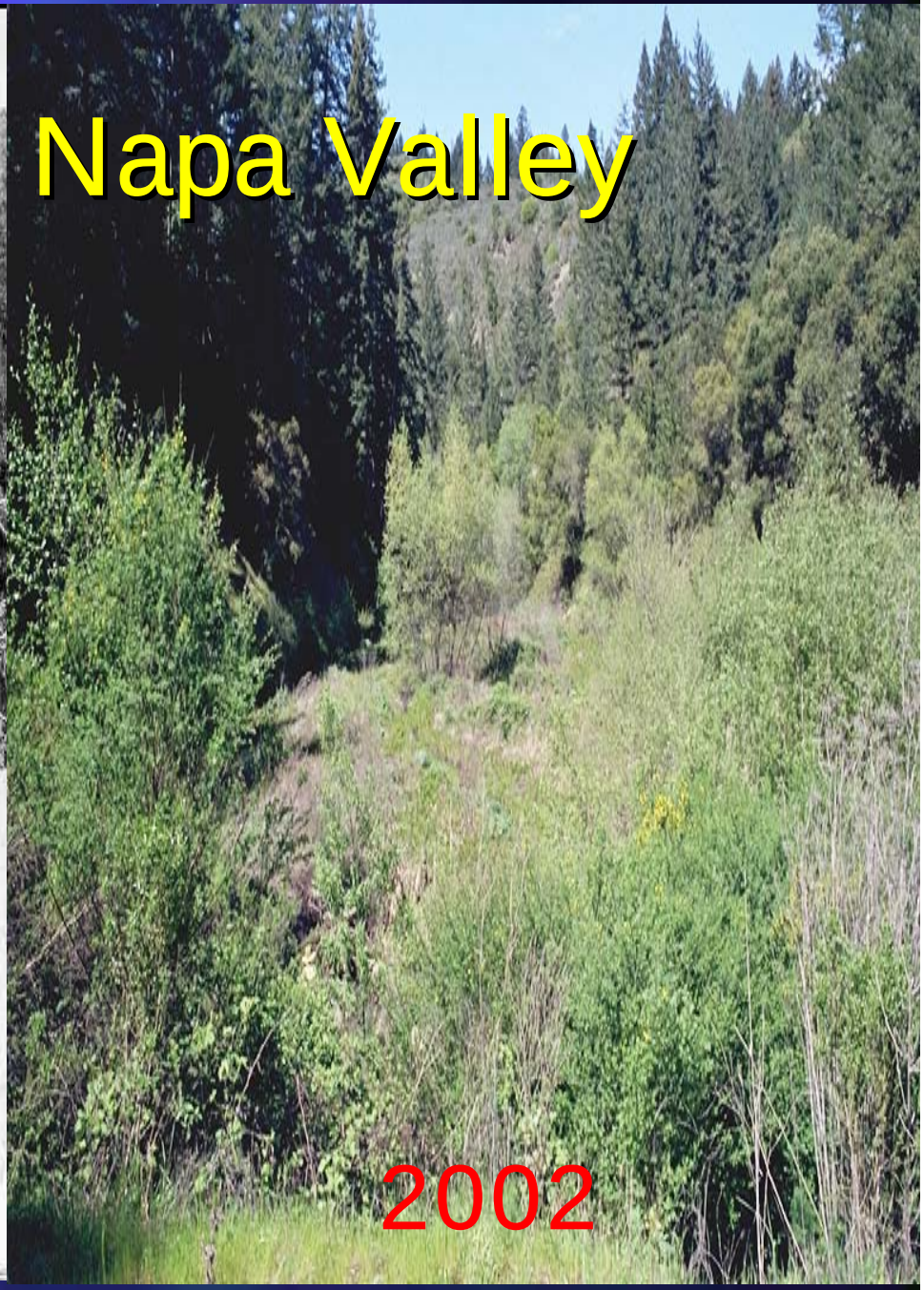
Searsville Dam - San Francisquito Cr.

York Creek Dam - York Creek

York Dam - Napa Valley



1950's



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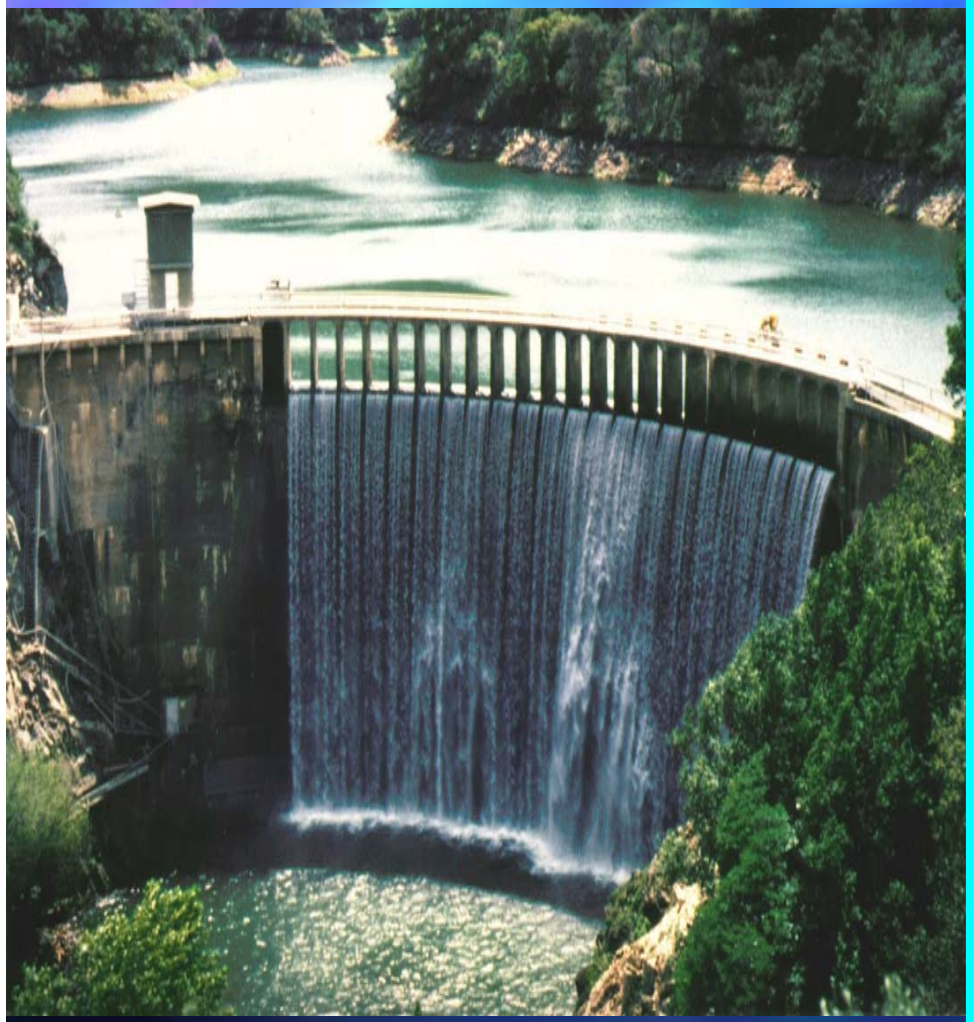
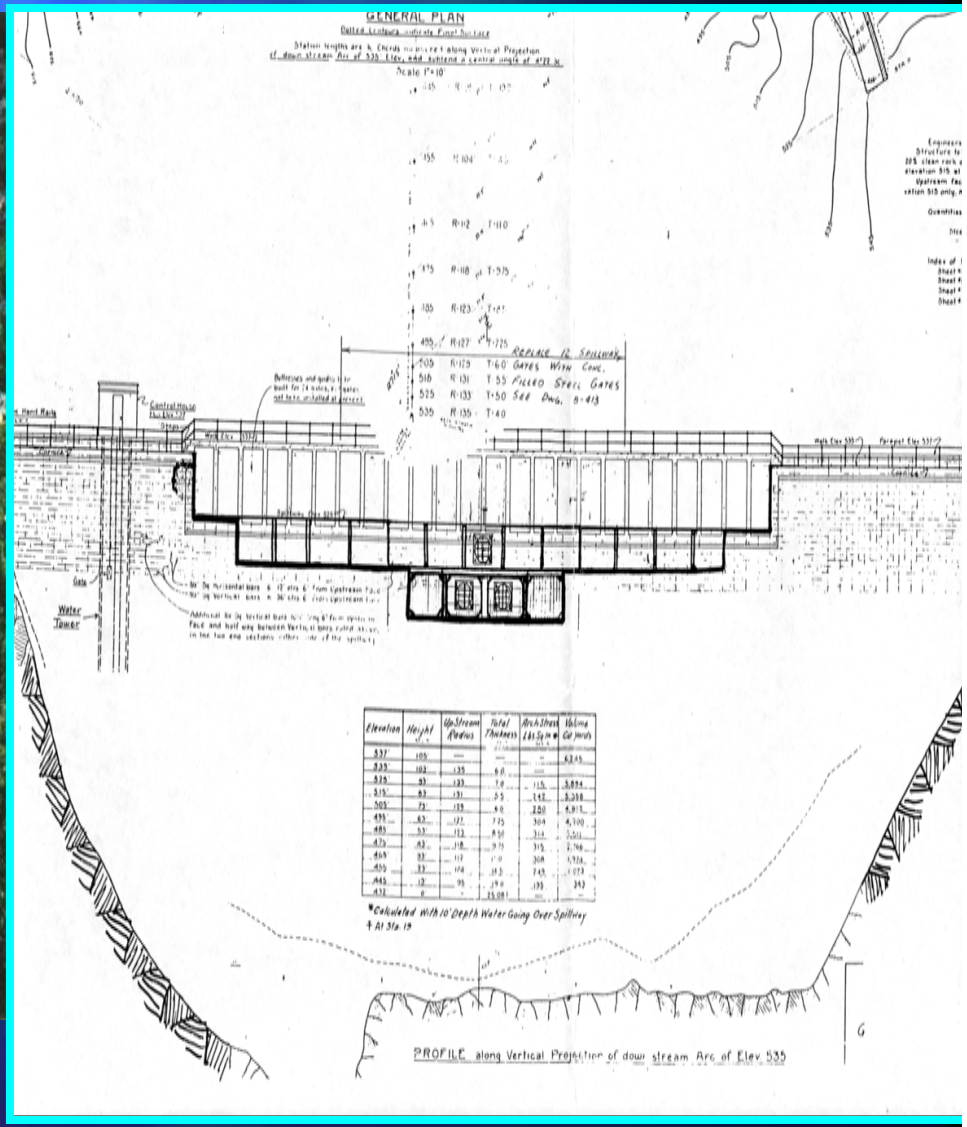
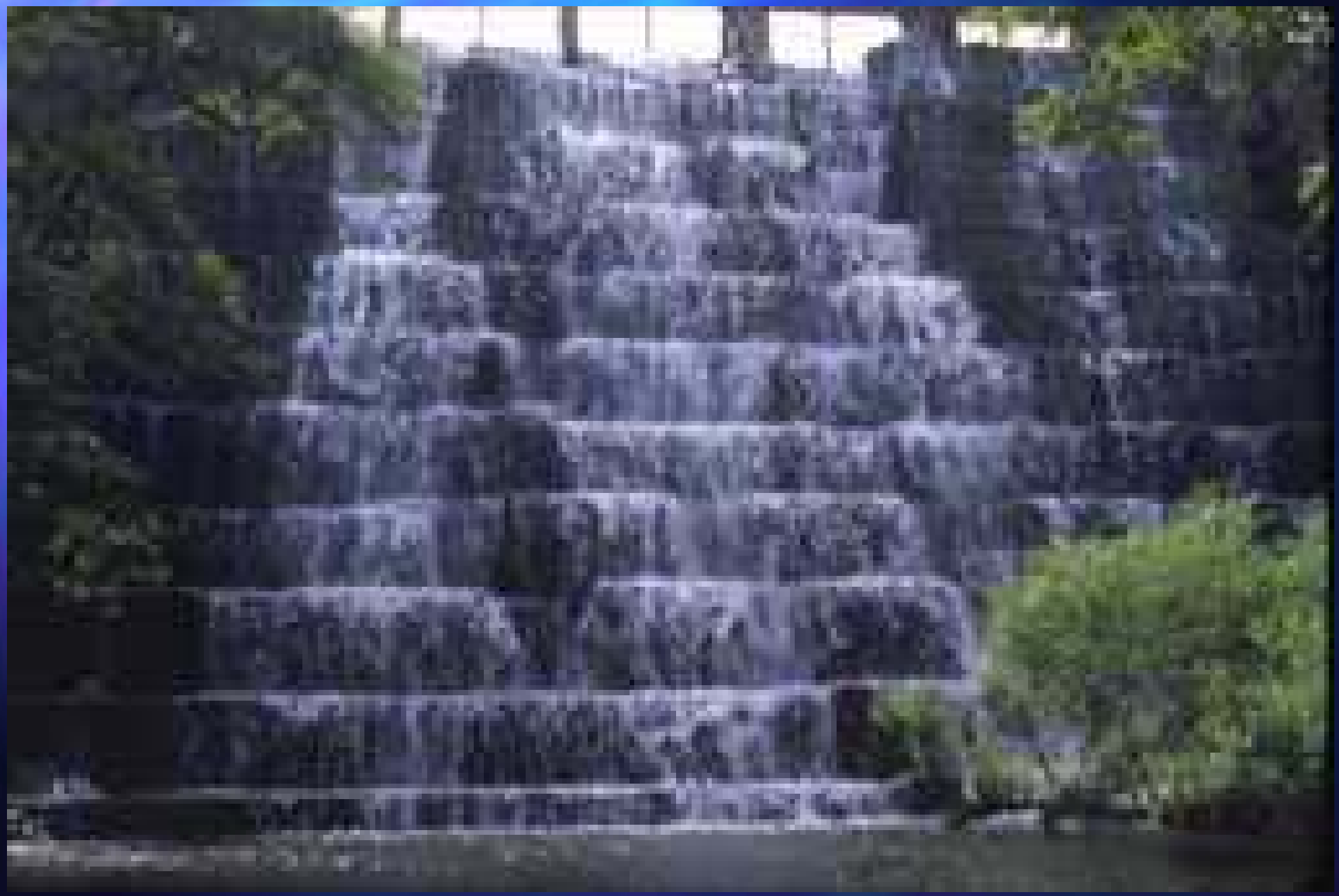
San Clemente Dam -Carmel River





Searsville Dam - Palo Alto



Matilija Dam - Ventura River

Englebright Dam - Yuba River

Hydropower and Fish Passage Issues

Risk Assessment/Cost-Benefit

- Ecosystem restoration vs Power needs

Relicensing

- Opportunity for re-operation/Mitigation

Water Quality and Quantity

- Instream Flow Protection

Sedimentation/Transport

- Dredging/Toxic residues

Public Safety/Obsolete Dams

Economic Obsolescence


The Beginning